



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Shorewood Homes Ltd

Project: Tree House, Larg Drive
Winchester, Hampshire, SO22 6NU

Contact: Scott Spearing
Scott Spearing
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Report Issue Date: 01/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	SAP-1425 - Plot 4	Issued on Date	01/03/2023	
Assessment Reference	REV-	Prop Type Ref		
Property	Tree House, Larg Drive, Winchester, Hampshire, SO22 6NU			
SAP Rating	92 A	DER	9.44	
Environmental	91 B	TER	16.27	
CO₂ Emissions (t/year)	1.30	% DER<TER	41.98	
General Requirements Compliance	Pass	DFEE	55.78	
		TFEE	64.73	
		% DFEE<TFEE	13.83	
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk		Assessor ID	p775-0001
Client	Shorewood Homes Ltd, SHOREWOOD HOMES			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.27	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.44	kgCO ₂ /m ²	Pass
	-6.83 (-42.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	64.73	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	55.78	kWh/m ² /yr	
	-8.9 (-13.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.15 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar 18i System ErP Efficiency: 89.7% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

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Secondary heating system

Room heaters - Wood Logs
Closed room heater
Efficiency: 65%
Minimum: 65%

Pass

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.25 kWh/day
Permitted by DBSCG 2.56

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

8.05 m², No overhang

Windows facing North East

3.03 m², No overhang

Windows facing South East

5.83 m², No overhang

Windows facing South West

5.06 m², No overhang

Windows facing North West

11.71 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Secondary heating (wood logs)

N/A

Secondary heating fuel:

wood logs

Photovoltaic array

3.20

kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

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Client	Shorewood Homes Ltd, SHOREWOOD HOMES				

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	49.60 m	112.23 m ²	2.53 m
1st Storey:	42.63 m	98.45 m ²	2.73 m

7.0 Living Area m²

8.0 Thermal Mass Parameter
 Thermal Mass
 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.18	60.00	241.30	202.91

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall Masonry	Dense block, plasterboard on dabs	75.00	112.95
Internal Wall Timber	Plasterboard on timber frame	9.00	184.28

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Bay Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	2.31	2.31
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	11.49	11.49
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	98.45	98.45

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	98.45

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	112.23

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	98.45

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Bifold Door	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Side Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] External Walls	North West							2.33	
Front Elevation	Window	[1] External Walls	North West	None	0.00					11.71	
Side Elevation	Window	[1] External Walls	North East	None	0.00					3.03	
Rear Elevation	Window	[1] External Walls	South East	None	0.00					5.83	
Bifold Doors	Window	[1] External Walls	North	None	0.00					8.05	
Side Elevation	Window	[1] External Walls	South West	None	0.00					5.06	
Side Door	Half Glazed Door	[1] External Walls	South West							2.38	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	21.72	0.300	No
Table K1 - Approved	E3 Sill	19.70	0.040	No
Table K1 - Approved	E4 Jamb	57.01	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	49.60	0.160	No
Table K1 - Approved	E5 Ground floor (normal)	49.60	0.160	Yes
Table K1 - Approved	E6 Intermediate floor within a dwelling	42.63	0.070	Yes
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	42.63	0.060	No
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	6.91	0.240	No
Table K1 - Default	E14 Flat roof	4.30	0.080	No
Table K1 - Default	E15 Flat roof with parapet	9.59	0.560	No
Table K1 - Approved	E16 Corner (normal)	33.55	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	12.50	-0.090	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Tested ?
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather
 Cross ventilation possible
 Night Ventilation
 Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	0	0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings
 Total number of L.E.L. fittings
 Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %
 Database Ref. No.
 Fuel Type
 Main Heating
 SAP Code
 In Winter
 In Summer
 Controls
 PCDF Controls
 Delayed Start Stat
 Sap Code
 Flue Type
 Fan Assisted Flue
 Is MHS Pumped
 Heat Emitter
 Underfloor Heating
 Flow Temperature

25.0 Main Heating 2

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Community Heating	None			
27.0 Secondary Heating	RWM			
Secondary Heating	SAP table			
Description	Wood Logs RWM Closed room heater			
SHS efficiency	65.00	%		
SAP Code	633			
HETAS Approved System	Yes			
Smoke Control Area	Unknown			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	Hot Water Cylinder			
Cylinder Stat	Yes			
Cylinder In Heated Space	Yes			
Independent Time Control	Yes			
Insulation Type	Measured Loss			
Cylinder Volume	250.00	L		
Loss	2.25	kWh/day		
Pipes insulation	Fully insulated primary pipework			
31.0 Thermal Store	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.20	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 211 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.27 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 55.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database
Worcester Greenstar 18i System ErP

Efficiency: 89.7% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: Room heaters - Wood Logs

Closed room heater
Efficiency: 65%
Minimum: 65% OK

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.25 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:
Overshading: Average
Windows facing North: 8.05 m², No overhang
Windows facing North East: 3.03 m², No overhang
Windows facing South East: 5.83 m², No overhang
Windows facing South West: 5.06 m², No overhang
Windows facing North West: 11.71 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 3.20 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.2300 (1b)	2.5300 (2b)	283.9419 (1b) - (3b)
First floor	98.4500 (1c)	2.7300 (2c)	268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				5 * 10 =	50.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.0905 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3405 (18)							
Number of sides sheltered				0	0 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3405 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4341	0.4256	0.4171	0.3745	0.3660	0.3234	0.3234	0.3149	0.3405	0.3660	0.3830	0.4000 (22b)
	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5800 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
Front Door			2.3300	1.4000	3.2620		(26)					
Windows (Uw = 1.40)			25.6300	1.3258	33.9792		(27)					
Bifold Door (Uw = 1.40)			8.0500	1.3258	10.6723		(27)					
Side Door			2.3800	1.4000	3.3320		(26a)					
Heat Loss Floor			112.2300	0.1200	13.4676	75.0000	8417.2500 (28a)					
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238	60.0000	12174.6000 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	11.4900		11.4900	0.1400	1.6086	9.0000	103.4100 (30)					
Pitched Cold Roof	98.4500		98.4500	0.1000	9.8450	9.0000	886.0500 (30)					
Total net area of external elements Aum(A, m ²)			465.7800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.0370		(33)					
Internal Wall Masonry			112.9500			75.0000	8471.2500 (32c)					
Internal Wall Timber			184.2800			9.0000	1658.5200 (32c)					
Internal Floor			98.4500			18.0000	1772.1000 (32d)					
Internal Ceiling			98.4500			18.0000	1772.1000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	35276.0700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.4391 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.8357 (36)					
Total fabric heat loss						(33) + (36) =	153.8727 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 108.3819	Feb 107.7146	Mar 107.0605	Apr 103.9883	May 103.4135	Jun 100.7377	Jul 100.7377	Aug 100.2422	Sep 101.7684	Oct 103.4135	Nov 104.5763	Dec 105.7920 (38)
Heat transfer coeff	262.2547	261.5874	260.9333	257.8610	257.2862	254.6104	254.6104	254.1149	255.6411	257.2862	258.4490	259.6647 (39)
Average = Sum(39)m / 12 =												257.8583 (39)
HLP	Jan 1.2448	Feb 1.2416	Mar 1.2385	Apr 1.2239	May 1.2212	Jun 1.2085	Jul 1.2085	Aug 1.2062	Sep 1.2134	Oct 1.2212	Nov 1.2267	Dec 1.2325 (40)
HLP (average)												1.2239 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0158 (42)
Average daily hot water use (litres/day)												105.8255 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1665.0476 (45)
Water storage loss:	25.8945	22.6475	23.3702	20.3747	19.5500	16.8701	15.6327	17.9387	18.1530	21.1555	23.0929	25.0774 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (62)
Heat gains from water heating, kWh/month												
	106.1413	94.2269	100.5458	92.3335	92.0777	84.5651	83.3943	88.5061	87.4087	95.6367	98.3589	104.3302 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.4504	31.4868	25.6068	19.3860	14.4912	12.2341	13.2194	17.1831	23.0631	29.2839	34.1786	36.4357 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.0857	385.0402	375.0750	353.8604	327.0807	301.9116	285.0971	281.1426	291.1078	312.3224	339.1021	364.2712 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)	142.6631	140.2185	135.1422	128.2409	123.7604	117.4515	112.0892	118.9598	121.4009	128.5439	136.6096	140.2287 (72)
Total internal gains	630.4364	627.9826	607.0611	572.7244	536.5695	502.8344	481.6428	488.5226	506.8090	541.3874	581.1274	612.1728 (73)

6. Solar gains

[Jan]			Area	Solar flux	g	FF	Access	Gains				
			m2	Table 6a	Specific data	Specific data	factor	W				
				W/m2	or Table 6b	or Table 6c	Table 6d					
Northeast			3.0300	11.2829	0.6300	0.7000	0.7700	10.4481 (75)				
Southeast			5.8300	36.7938	0.6300	0.7000	0.7700	65.5564 (77)				
Southwest			5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)				
Northwest			11.7100	11.2829	0.6300	0.7000	0.7700	40.3786 (81)				
North			8.0500	10.6334	0.6300	0.7000	0.7700	26.1601 (74)				
Solar gains	199.4413	362.0378	556.7468	796.1949	991.3867	1028.6886	973.2095	820.3467	638.2933	416.4770	242.8972	168.1115 (83)
Total gains	829.8777	990.0204	1163.8080	1368.9193	1527.9562	1531.5230	1454.8523	1308.8694	1145.1023	957.8644	824.0247	780.2843 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	37.3641	37.4594	37.5533	38.0007	38.0856	38.4859	38.4859	38.5609	38.3307	38.0856	37.9143	37.7368
alpha	3.4909	3.4973	3.5036	3.5334	3.5390	3.5657	3.5657	3.5707	3.5554	3.5390	3.5276	3.5158
util living area	0.9976	0.9952	0.9888	0.9687	0.9150	0.8045	0.6699	0.7351	0.9122	0.9829	0.9957	0.9981 (86)
MIT	19.3524	19.4953	19.7572	20.1264	20.4814	20.7471	20.8593	20.8321	20.6036	20.1526	19.6926	19.3341 (87)
Th 2	19.8843	19.8868	19.8893	19.9009	19.9031	19.9132	19.9132	19.9151	19.9093	19.9031	19.8987	19.8941 (88)
util rest of house	0.9969	0.9939	0.9857	0.9591	0.8856	0.7302	0.5418	0.6154	0.8691	0.9762	0.9944	0.9976 (89)
MIT 2	17.6603	17.8709	18.2547	18.7973	19.2981	19.6491	19.7661	19.7469	19.4785	18.8415	18.1682	17.6405 (90)
Living area fraction									fLA = Living area / (4) =			0.0993 (91)
MIT	17.8284	18.0323	18.4040	18.9293	19.4157	19.7582	19.8747	19.8548	19.5902	18.9717	18.3196	17.8087 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8284	18.0323	18.4040	18.9293	19.4157	19.7582	19.8747	19.8548	19.5902	18.9717	18.3196	17.8087 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	825.8846	980.9006	1140.1742	1296.8271	1327.5189	1098.8384	780.7055	795.1164	975.8553	926.8578	817.0316	777.2776 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
Month fracti	3547.8782	3435.2412	3106.1388	2586.1716	1985.1336	1313.3308	833.7843	877.9038	1403.5294	2153.9343	2899.7070	3533.7029 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	2025.1632	1649.3169	1462.6777	928.3280	489.2653	0.0000	0.0000	0.0000	0.0000	912.9449	1499.5263	2050.7804 (98)
Space heating												11018.0028 (98)
Space heating per m2												(98) / (4) = 52.2973 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)
Efficiency of main space heating system 1 (in %)	90.7000 (206)
Efficiency of secondary/supplementary heating system, %	65.0000 (208)
Space heating requirement	10932.9686 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2025.1632	1649.3169	1462.6777	928.3280	489.2653	0.0000	0.0000	0.0000	0.0000	912.9449	1499.5263	2050.7804 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	2009.5335	1636.5879	1451.3891	921.1634	485.4893	0.0000	0.0000	0.0000	0.0000	905.8990	1487.9534	2034.9530 (211)
Water heating requirement	311.5636	253.7411	225.0273	142.8197	75.2716	0.0000	0.0000	0.0000	0.0000	140.4531	230.6964	315.5047 (215)
Water heating requirement	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (64)
Efficiency of water heater (217)m	89.3427	89.2453	89.0169	88.4630	87.1695	80.0000	80.0000	80.0000	80.0000	88.3680	89.0765	89.3850 (217)
Fuel for water heating, kWh/month	261.4173	230.8407	243.4688	220.1974	219.4124	214.2871	206.4315	225.6486	224.9772	228.5491	239.0246	255.1997 (219)
Water heating fuel used												2769.4543 (219)
Annual totals kWh/year												10932.9686 (211)
Space heating fuel - main system												1695.0774 (215)
Space heating fuel - secondary												

Electricity for pumps and fans:

central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	626.0659 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 3.20 * 1029 * 1.00) =	-2634.7180	-2634.7180 (233)
Total delivered energy for all uses		13463.8482 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	10932.9686	0.2160	2361.5212 (261)
Space heating - secondary	1695.0774	0.0190	32.2065 (263)
Water heating (other fuel)	2769.4543	0.2160	598.2021 (264)
Space and water heating			2991.9298 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	626.0659	0.5190	324.9282 (268)
Energy saving/generation technologies			
PV Unit	-2634.7180	0.5190	-1367.4186 (269)
Total CO2, kg/year			1988.3644 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.4400 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER	9.4400	ZC1
Total Floor Area	210.6800	TFA
Assumed number of occupants	3.0158	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	10.7188	ZC2
CO2 emissions from cooking, equation (L16)	0.9084	ZC3
Total CO2 emissions	21.0672	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	21.0672	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.2300 (1b)	2.5300 (2b)	283.9419 (1b) - (3b)
First floor	98.4500 (1c)	2.7300 (2c)	268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0724 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3224 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4110	0.4030	0.3949	0.3546	0.3465	0.3063	0.3063	0.2982	0.3224	0.3465	0.3627	0.3788 (22b)
	0.5845	0.5812	0.5780	0.5629	0.5600	0.5469	0.5469	0.5445	0.5520	0.5600	0.5658	0.5717 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.3300	1.0000	2.3300		(26)
TER Semi-glazed door			2.3800	1.2000	2.8560		(26a)
TER Opening Type (Uw = 1.40)			33.6800	1.3258	44.6515		(27)
Heat Loss Floor			112.2300	0.1300	14.5899		(28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238		(29a)
Bay Roof	2.3100		2.3100	0.1300	0.3003		(30)
Flat Roof	11.4900		11.4900	0.1300	1.4937		(30)
Pitched Cold Roof	98.4500		98.4500	0.1300	12.7985		(30)
Total net area of external elements Aum(A, m ²)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		115.5437 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K												250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												32.6186 (36)
Total fabric heat loss												(33) + (36) = 148.1623 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	106.6040	106.0058	105.4193	102.6650	102.1496	99.7506	99.7506	99.3064	100.6747	102.1496	103.1921	104.2821 (38)
Heat transfer coeff	254.7663	254.1681	253.5817	250.8273	250.3119	247.9129	247.9129	247.4687	248.8370	250.3119	251.3545	252.4444 (39)
Average = Sum(39)m / 12 =												250.8248 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2093	1.2064	1.2036	1.1906	1.1881	1.1767	1.1767	1.1746	1.1811	1.1881	1.1931	1.1982 (40)
HLP (average)												1.1905 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0158 (42)
Average daily hot water use (litres/day)												105.8255 (43)
Daily hot water use	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy conte	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Energy content (annual)												Total = Sum(45)m = 1665.0476 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.8945	22.6475	23.3702	20.3747	19.5500	16.8701	15.6327	17.9387	18.1530	21.1555	23.0929	25.0774 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	227.5366	200.5764	210.7079	188.9668	185.2400	165.6033	159.1246	174.4983	174.1554	195.9437	207.0884	222.0896 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	227.5366	200.5764	210.7079	188.9668	185.2400	165.6033	159.1246	174.4983	174.1554	195.9437	207.0884	222.0896 (64)
Heat gains from water heating, kWh/month	101.3248	89.8765	95.7293	87.6723	87.2612	79.9040	78.5779	83.6896	82.7476	90.8202	93.6978	99.5137 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.4504	31.4868	25.6068	19.3860	14.4912	12.2341	13.2194	17.1831	23.0631	29.2839	34.1786	36.4357 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.0857	385.0402	375.0750	353.8604	327.0807	301.9116	285.0971	281.1426	291.1078	312.3224	339.1021	364.2712 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)	136.1893	133.7448	128.6684	121.7671	117.2866	110.9778	105.6154	112.4860	114.9272	122.0702	130.1358	133.7550 (72)
Total internal gains	623.9626	621.5089	600.5874	566.2507	530.0957	496.3606	475.1691	482.0489	500.3352	534.9136	574.6537	605.6990 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
North	8.0500	10.6334	0.6300	0.7000	0.7700	26.1601 (74)						
Northeast	3.0300	11.2829	0.6300	0.7000	0.7700	10.4481 (75)						
Southeast	5.8300	36.7938	0.6300	0.7000	0.7700	65.5564 (77)						
Southwest	5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)						
Northwest	11.7100	11.2829	0.6300	0.7000	0.7700	40.3786 (81)						
Solar gains	199.4413	362.0378	556.7468	796.1949	991.3867	1028.6886	973.2095	820.3467	638.2933	416.4770	242.8972	168.1115 (83)
Total gains	823.4039	983.5466	1157.3342	1362.4455	1521.4824	1525.0493	1448.3786	1302.3956	1138.6285	951.3906	817.5509	773.8105 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.4273	57.5625	57.6956	58.3292	58.4493	59.0149	59.0149	59.1208	58.7957	58.4493	58.2069	57.9556
alpha	4.8285	4.8375	4.8464	4.8886	4.8966	4.9343	4.9343	4.9414	4.9197	4.8966	4.8805	4.8637
util living area	0.9997	0.9992	0.9975	0.9889	0.9530	0.8475	0.6968	0.7712	0.9510	0.9954	0.9994	0.9998 (86)
MIT	19.4867	19.6280	19.8864	20.2532	20.6113	20.8695	20.9638	20.9406	20.7189	20.2668	19.8160	19.4678 (87)
Th 2	19.9126	19.9149	19.9171	19.9276	19.9295	19.9387	19.9387	19.9404	19.9351	19.9295	19.9256	19.9214 (88)
util rest of house	0.9996	0.9989	0.9964	0.9838	0.9288	0.7677	0.6384	0.6384	0.9145	0.9927	0.9991	0.9997 (89)
MIT 2	17.8750	18.0835	18.4628	19.0036	19.5101	19.8394	19.9235	19.9113	19.6685	19.0277	18.3663	17.8534 (90)
Living area fraction												FLA = Living area / (4) = 0.0993 (91)
MIT	18.0351	18.2369	18.6043	19.1277	19.6195	19.9417	20.0269	20.0136	19.7728	19.1508	18.5103	18.0138 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0351	18.2369	18.6043	19.1277	19.6195	19.9417	20.0269	20.0136	19.7728	19.1508	18.5103	18.0138 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	822.8216	981.7900	1150.9302	1332.7677	1398.9091	1171.1374	823.1990	845.2824	1032.3530	941.3337	816.2719	773.4128 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3499.2484	3389.8244	3069.4215	2565.3979	1982.3506	1324.2810	849.5697	894.2469	1411.6061	2140.3601	2868.0286	3487.2173 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1991.2616	1618.1991	1427.3575	887.4937	434.0805	0.0000	0.0000	0.0000	0.0000	892.0757	1477.2649	2019.0706 (98)
Space heating												10746.8035 (98)
Space heating per m2												(98) / (4) = 51.0101 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													11493.9074 (211)
Space heating requirement	1991.2616	1618.1991	1427.3575	887.4937	434.0805	0.0000	0.0000	0.0000	0.0000	892.0757	1477.2649	2019.0706	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	2129.6915	1730.6942	1526.5855	949.1912	464.2572	0.0000	0.0000	0.0000	0.0000	954.0916	1579.9624	2159.4338	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	227.5366	200.5764	210.7079	188.9668	185.2400	165.6033	159.1246	174.4983	174.1554	195.9437	207.0884	222.0896	(64)
Efficiency of water heater (217)m	89.2725	89.1813	88.9656	88.4188	87.0104	79.8000	79.8000	79.8000	79.8000	88.3662	89.0323	89.3133	(217)
Fuel for water heating, kWh/month	254.8788	224.9086	236.8421	213.7178	212.8940	207.5229	199.4043	218.6695	218.2398	221.7406	232.5993	248.6636	(219)
Water heating fuel used												2690.0814	(219)
Annual totals kWh/year													
Space heating fuel - main system													11493.9074 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													626.0659 (232)
Total delivered energy for all uses													14885.0547 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	11493.9074	0.2160	2482.6840 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2690.0814	0.2160	581.0576 (264)
Space and water heating			3063.7416 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	626.0659	0.5190	324.9282 (268)
Total CO2, kg/m2/year			3427.5948 (272)
Emissions per m2 for space and water heating			14.5422 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5423 (272b)
Emissions per m2 for pumps and fans			0.1848 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5422 * 1.00) + 1.5423 + 0.1848, rounded to 2 d.p.			16.2700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.2300 (1b)	2.5300 (2b)	283.9419 (1b) - (3b)
First floor	98.4500 (1c)	2.7300 (2c)	268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0724 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3224 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4110	0.4030	0.3949	0.3546	0.3465	0.3063	0.3063	0.2982	0.3224	0.3465	0.3627	0.3788 (22b)
	0.5845	0.5812	0.5780	0.5629	0.5600	0.5469	0.5469	0.5445	0.5520	0.5600	0.5658	0.5717 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			25.6300	1.3258	33.9792		(27)
Bifold Door (Uw = 1.40)			8.0500	1.3258	10.6723		(27)
Side Door			2.3800	1.4000	3.3320		(26a)
Heat Loss Floor			112.2300	0.1200	13.4676	75.0000	8417.2500 (28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238	60.0000	12174.6000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.4900		11.4900	0.1400	1.6086	9.0000	103.4100 (30)
Pitched Cold Roof	98.4500		98.4500	0.1000	9.8450	9.0000	886.0500 (30)
Total net area of external elements Aum(A, m ²)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.0370		(33)
Internal Wall Masonry			112.9500			75.0000	8471.2500 (32c)
Internal Wall Timber			184.2800			9.0000	1658.5200 (32c)
Internal Floor			98.4500			18.0000	1772.1000 (32d)
Internal Ceiling			98.4500			9.0000	886.0500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34390.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							163.2334 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.8357 (36)
Total fabric heat loss						(33) + (36) =	153.8727 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	106.6040	106.0058	105.4193	102.6650	102.1496	99.7506	99.7506	99.3064	100.6747	102.1496	103.1921	104.2821 (38)
Heat transfer coeff	260.4767	259.8785	259.2921	256.5377	256.0223	253.6233	253.6233	253.1791	254.5474	256.0223	257.0649	258.1548 (39)
Average = Sum(39)m / 12 =												256.5352 (39)
HLP	1.2364	1.2335	1.2307	1.2177	1.2152	1.2038	1.2038	1.2017	1.2082	1.2152	1.2202	1.2253 (40)
HLP (average)												1.2177 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0158 (42)											
Average daily hot water use (litres/day)	105.8255 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1665.0476 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.6838	32.0839	33.1077	28.8641	27.6958	23.8994	22.1463	25.4132	25.7167	29.9703	32.7150	35.5263 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts (66)m	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.4504	31.4868	25.6068	19.3860	14.4912	12.2341	13.2194	17.1831	23.0631	29.2839	34.1786	36.4357 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.0857	385.0402	375.0750	353.8604	327.0807	301.9116	285.0971	281.1426	291.1078	312.3224	339.1021	364.2712 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)	49.3062	47.7439	44.4996	40.0891	37.2256	33.1936	29.7665	34.1575	35.7176	40.2827	45.4375	47.7505 (72)
Total internal gains	534.0795	532.5080	513.4186	481.5726	447.0347	415.5765	396.3202	400.7204	418.1257	450.1262	486.9553	516.6945 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.0300	11.2829	0.6300	0.7000	0.7700	10.4481 (75)						
Southeast	5.8300	36.7938	0.6300	0.7000	0.7700	65.5564 (77)						
Southwest	5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)						
Northwest	11.7100	11.2829	0.6300	0.7000	0.7700	40.3786 (81)						
North	8.0500	10.6334	0.6300	0.7000	0.7700	26.1601 (74)						
Solar gains	199.4413	362.0378	556.7468	796.1949	991.3867	1028.6886	973.2095	820.3467	638.2933	416.4770	242.8972	168.1115 (83)
Total gains	733.5208	894.5458	1070.1654	1277.7674	1438.4213	1444.2651	1369.5297	1221.0671	1056.4190	866.6031	729.8525	684.8060 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	36.6742	36.7587	36.8418	37.2374	37.3123	37.6652	37.6652	37.7313	37.5285	37.3123	37.1610	37.0041
alpha	3.4449	3.4506	3.4561	3.4825	3.4875	3.5110	3.5110	3.5154	3.5019	3.4875	3.4774	3.4669
util living area	0.9982	0.9962	0.9907	0.9727	0.9238	0.8214	0.6929	0.7598	0.9252	0.9865	0.9968	0.9986 (86)
MIT	18.8247	19.0186	19.3745	19.8757	20.3640	20.7352	20.8988	20.8563	20.5284	19.9073	19.2821	18.7974 (87)
Th 2	19.8910	19.8933	19.8955	19.9059	19.9078	19.9169	19.9169	19.9186	19.9134	19.9078	19.9039	19.8998 (88)
util rest of house	0.9977	0.9952	0.9881	0.9644	0.8971	0.7509	0.5661	0.6438	0.8874	0.9811	0.9959	0.9983 (89)
MIT 2	17.8892	18.0844	18.4408	18.9447	19.4177	19.7569	19.8770	19.8551	19.5851	18.9814	18.3557	17.8683 (90)
Living area fraction									fLA = Living area / (4) =			0.0993 (91)
MIT	17.9821	18.1772	18.5336	19.0372	19.5117	19.8541	19.9785	19.9546	19.6788	19.0734	18.4477	17.9606 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9821	18.1772	18.5336	19.0372	19.5117	19.8541	19.9785	19.9546	19.6788	19.0734	18.4477	17.9606 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	731.0047	888.2456	1052.6039	1220.6895	1272.7038	1077.4236	786.5653	791.6912	925.9692	845.0420	725.4199	682.9688 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	3563.8713	3450.4633	3120.2091	2600.5736	1999.9642	1332.5612	856.8597	899.9422	1420.0642	2169.3709	2917.0939	3552.3657 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	2107.6528	1721.8103	1538.2983	993.5166	541.0818	0.0000	0.0000	0.0000	0.0000	985.3007	1578.0052	2134.8313 (98)
Space heating												11600.4969 (98)
Space heating per m2												(98) / (4) = 55.0622 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2384.0595	1876.8128	1924.1611	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6672	0.7485	0.6942	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1590.6753	1404.8361	1335.8387	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1833.1834	1742.2775	1572.0047	0.0000	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	174.6058	251.0565	175.7075	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling													601.3698 (104)
Cooled fraction													1.0000 (105)
Intermittency factor (Table 10b)													
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh													
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	43.6515	62.7641	43.9269	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													150.3425 (107)
Space cooling per m2													0.7136 (108)
Energy for space heating													55.0622 (99)
Energy for space cooling													0.7136 (108)
Total													55.7758 (109)
Dwelling Fabric Energy Efficiency (DFEE)													55.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	112.2300 (1b)	2.5300 (2b)	283.9419 (1b) - (3b)
First floor	98.4500 (1c)	2.7300 (2c)	268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.0724 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3224 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3224 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4110	0.4030	0.3949	0.3546	0.3465	0.3063	0.3063	0.2982	0.3224	0.3465	0.3627	0.3788 (22b)
Effective ac	0.5845	0.5812	0.5780	0.5629	0.5600	0.5469	0.5469	0.5445	0.5520	0.5600	0.5658	0.5717 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.3300	1.0000	2.3300		(26)
TER Semi-glazed door			2.3800	1.2000	2.8560		(26a)
TER Opening Type (Uw = 1.40)			33.6800	1.3258	44.6515		(27)
Heat Loss Floor			112.2300	0.1300	14.5899		(28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238		(29a)
Bay Roof	2.3100		2.3100	0.1300	0.3003		(30)
Flat Roof	11.4900		11.4900	0.1300	1.4937		(30)
Pitched Cold Roof	98.4500		98.4500	0.1300	12.7985		(30)
Total net area of external elements Aum(A, m2)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		115.5437 (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 32.6186 (36)
 Total fabric heat loss (33) + (36) = 148.1623 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	106.6040	106.0058	105.4193	102.6650	102.1496	99.7506	99.7506	99.3064	100.6747	102.1496	103.1921	104.2821 (38)
Average = Sum(39)m / 12 =	254.7663	254.1681	253.5817	250.8273	250.3119	247.9129	247.9129	247.4687	248.8370	250.3119	251.3545	252.4444 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2093	1.2064	1.2036	1.1906	1.1881	1.1767	1.1767	1.1746	1.1811	1.1881	1.1931	1.1982 (40)
HLP (average)												1.1905 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0158 (42)
 Average daily hot water use (litres/day) 105.8255 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1665.0476 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	36.6838	32.0839	33.1077	28.8641	27.6958	23.8994	22.1463	25.4132	25.7167	29.9703	32.7150	35.5263	35.5263	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	150.7906	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.4504	31.4868	25.6068	19.3860	14.4912	12.2341	13.2194	17.1831	23.0631	29.2839	34.1786	36.4357	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.0857	385.0402	375.0750	353.8604	327.0807	301.9116	285.0971	281.1426	291.1078	312.3224	339.1021	364.2712	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	38.0791	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	(71)
Water heating gains (Table 5)	49.3062	47.7439	44.4996	40.0891	37.2256	33.1936	29.7665	34.1575	35.7176	40.2827	45.4375	47.7505	(72)
Total internal gains	534.0795	532.5080	513.4186	481.5726	447.0347	415.5765	396.3202	400.7204	418.1257	450.1262	486.9553	516.6945	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	8.0500	10.6334	0.6300	0.7000	0.7700	26.1601 (74)
Northeast	3.0300	11.2829	0.6300	0.7000	0.7700	10.4481 (75)
Southeast	5.8300	36.7938	0.6300	0.7000	0.7700	65.5564 (77)
Southwest	5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)
Northwest	11.7100	11.2829	0.6300	0.7000	0.7700	40.3786 (81)

Solar gains	199.4413	362.0378	556.7468	796.1949	991.3867	1028.6886	973.2095	820.3467	638.2933	416.4770	242.8972	168.1115	(83)
Total gains	733.5208	894.5458	1070.1654	1277.7674	1438.4213	1444.2651	1369.5297	1221.0671	1056.4190	866.6031	729.8525	684.8060	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	57.4273	57.5625	57.6956	58.3292	58.4493	59.0149	59.0149	59.1208	58.7957	58.4493	58.2069	57.9556		
alpha	4.8285	4.8375	4.8464	4.8886	4.8966	4.9343	4.9343	4.9414	4.9197	4.8966	4.8805	4.8637		
util living area	0.9998	0.9995	0.9982	0.9915	0.9616	0.8680	0.7253	0.8012	0.9626	0.9969	0.9996	0.9999	(86)	
MIT	19.4471	19.5889	19.8484	20.2176	20.5818	20.8523	20.9567	20.9290	20.6897	20.2300	19.7774	19.4285	(87)	
Th 2	19.9126	19.9149	19.9171	19.9276	19.9295	19.9387	19.9387	19.9404	19.9351	19.9295	19.9256	19.9214	(88)	
util rest of house	0.9998	0.9993	0.9975	0.9875	0.9409	0.7932	0.5834	0.6719	0.9328	0.9951	0.9995	0.9998	(89)	
MIT 2	18.4819	18.6254	18.8863	19.2620	19.6167	19.8598	19.9259	19.9156	19.7283	19.2774	18.8223	18.4702	(90)	
Living area fraction									fLA = Living area / (4) =			0.0993	(91)	
MIT	18.5777	18.7211	18.9819	19.3569	19.7126	19.9584	20.0283	20.0163	19.8238	19.3721	18.9172	18.5654	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.5777	18.7211	18.9819	19.3569	19.7126	19.9584	20.0283	20.0163	19.8238	19.3721	18.9172	18.5654	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9996	0.9990	0.9965	0.9845	0.9354	0.7949	0.5968	0.6828	0.9284	0.9936	0.9992	0.9998	(94)	
Useful gains	733.2638	893.6539	1066.4619	1258.0010	1345.4410	1148.0874	817.3776	833.7987	980.7814	861.0499	729.2692	684.6386	(95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	3637.4886	3512.8872	3165.1834	2622.8735	2005.6515	1328.4068	849.9254	894.9194	1424.3008	2195.7551	2970.3019	3626.4634	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	2160.7432	1760.1248	1561.4488	982.7082	491.1966	0.0000	0.0000	0.0000	0.0000	993.0207	1613.5436	2188.7176	(98)	
Space heating												11751.5036	(98)	
Space heating per m2												(98) / (4) =	55.7789	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2330.3817	1834.5558	1880.7621	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7190	0.8093	0.7495	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1675.5504	1484.7640	1409.6820	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1833.1834	1742.2775	1572.0047	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	113.4958	191.5901	120.7681	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												425.8540 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	28.3739	47.8975	30.1920	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												106.4635 (107)
Space cooling per m2												0.5053 (108)
Energy for space heating												55.7789 (99)
Energy for space cooling												0.5053 (108)
Total												56.2843 (109)
Target Fabric Energy Efficiency (TFEE)												64.7 (109)

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Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.2300 (1b)	x 2.5300 (2b)	= 283.9419 (1b) - (3b)
First floor	98.4500 (1c)	x 2.7300 (2c)	= 268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				5 * 10 =	50.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				50.0000 / (5) =	0.0905 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3405 (18)							
Number of sides sheltered				0	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3405 (21)							
Wind speed	Jan 4.1000	Feb 3.8000	Mar 3.9000	Apr 3.7000	May 3.6000	Jun 3.3000	Jul 3.3000	Aug 3.2000	Sep 3.2000	Oct 3.4000	Nov 3.3000	Dec 3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.9250	0.9000	0.8250	0.8250	0.8000	0.8000	0.8500	0.8250	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3490	0.3234	0.3320	0.3149	0.3064	0.2809	0.2809	0.2724	0.2724	0.2894	0.2809	0.3149 (22b)
	0.5609	0.5523	0.5551	0.5496	0.5469	0.5394	0.5394	0.5371	0.5371	0.5419	0.5394	0.5496 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			25.6300	1.3258	33.9792		(27)
Bifold Door (Uw = 1.40)			8.0500	1.3258	10.6723		(27)
Side Door			2.3800	1.4000	3.3320		(26a)
Heat Loss Floor			112.2300	0.1200	13.4676	75.0000	8417.2500 (28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238	60.0000	12174.6000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.4900		11.4900	0.1400	1.6086	9.0000	103.4100 (30)
Pitched Cold Roof	98.4500		98.4500	0.1000	9.8450	9.0000	886.0500 (30)
Total net area of external elements Aum(A, m ²)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.0370		(33)
Internal Wall Masonry			112.9500			75.0000	8471.2500 (32c)
Internal Wall Timber			184.2800			9.0000	1658.5200 (32c)
Internal Floor			98.4500			18.0000	1772.1000 (32d)
Internal Ceiling			98.4500			18.0000	1772.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	35276.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.4391 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.8357 (36)
Total fabric heat loss						(33) + (36) =	153.8727 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	102.3035	100.7377	101.2464	100.2422	99.7598	98.3922	98.3922	97.9628	97.9628	98.8349	98.3922	100.2422 (38)
Average = Sum(39)m / 12 =	256.1762	254.6104	255.1191	254.1149	253.6326	252.2649	252.2649	251.8355	251.8355	252.7076	252.2649	254.1149 (39)
												253.4118 (39)
HLP	1.2159	1.2085	1.2109	1.2062	1.2039	1.1974	1.1974	1.1953	1.1953	1.1995	1.1974	1.2062 (40)
HLP (average)												1.2028 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily hot water use (litres/day)												3.0158 (42)
												105.8255 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m = 1665.0476 (45)											
Water storage loss:	25.8945	22.6475	23.3702	20.3747	19.5500	16.8701	15.6327	17.9387	18.1530	21.1555	23.0929	25.0774 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												250.0000 (47)
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												2.2500 (48)
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												228.1102 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												0.0000 (63)
	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (64)
RHI water heating demand												2382.4186 (64)
Heat gains from water heating, kWh/month												2382.4186 (64)
	106.1413	94.2269	100.5458	92.3335	92.0777	84.5651	83.3943	88.5061	87.4087	95.6367	98.3589	104.3302 (65)
												2382 (64)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	88.6261	78.7169	64.0169	48.4649	36.2281	30.5853	33.0485	42.9577	57.6577	73.2097	85.4465	91.0893 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	568.7846	574.6868	559.8135	528.1498	488.1802	450.6143	425.5181	419.6158	434.4892	466.1528	506.1225	543.6883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)												
	142.6631	140.2185	135.1422	128.2409	123.7604	117.4515	112.0892	118.9598	121.4009	128.5439	136.6096	140.2287 (72)
Total internal gains	919.5007	913.0492	878.3994	824.2826	767.5955	718.0781	690.0826	700.9602	732.9747	787.3334	847.6055	894.4333 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.0300	14.6223	0.6300	0.7000	0.7700	13.5404 (75)						
Southeast	5.8300	45.2918	0.6300	0.7000	0.7700	80.6974 (77)						
Southwest	5.0600	45.2918	0.6300	0.7000	0.7700	70.0393 (79)						
Northwest	11.7100	14.6223	0.6300	0.7000	0.7700	52.3293 (81)						
North	8.0500	13.4995	0.6300	0.7000	0.7700	33.2112 (74)						
Solar gains	249.8176	387.9065	600.2748	866.7334	1024.7021	1156.9184	1074.8074	929.0514	724.9366	476.7110	296.6151	199.0775 (83)
Total gains	1169.3183	1300.9556	1478.6743	1691.0160	1792.2976	1874.9964	1764.8900	1630.0116	1457.9113	1264.0443	1144.2206	1093.5107 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.2507	38.4859	38.4091	38.5609	38.6343	38.8437	38.8437	38.9100	38.9100	38.7757	38.8437	38.5609
alpha	3.5500	3.5657	3.5606	3.5707	3.5756	3.5896	3.5896	3.5940	3.5940	3.5850	3.5896	3.5707
util living area	0.9916	0.9868	0.9725	0.9319	0.8396	0.6528	0.4786	0.5361	0.8023	0.9499	0.9850	0.9933 (86)
MIT	19.6154	19.7481	20.0072	20.3462	20.6564	20.8517	20.9076	20.8990	20.7609	20.3883	19.9622	19.5946 (87)
Th 2	19.9073	19.9132	19.9113	19.9151	19.9169	19.9221	19.9221	19.9237	19.9237	19.9204	19.9221	19.9151 (88)
util rest of house	0.9896	0.9835	0.9651	0.9122	0.7896	0.5538	0.3411	0.3958	0.7238	0.9309	0.9805	0.9916 (89)
MIT 2	18.0602	18.2575	18.6313	19.1158	19.5348	19.7614	19.8061	19.8035	19.6761	19.1874	18.5768	18.0357 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2147	18.4056	18.7680	19.2381	19.6462	19.8697	19.9155	19.9123	19.7839	19.3067	18.7144	18.1906 (92)
Temperature adjustment												
adjusted MIT	18.2147	18.4056	18.7680	19.2381	19.6462	19.8697	19.9155	19.9123	19.7839	19.3067	18.7144	18.1906 (93)

8. Space heating requirement

Utilisation	0.9848	0.9769	0.9544	0.8964	0.7747	0.5485	0.3403	0.3942	0.7116	0.9163	0.9731	0.9876 (94)
Useful gains	1151.5995	1270.9672	1411.2720	1515.8528	1388.4762	1028.3757	600.5104	642.5932	1037.3982	1158.2309	1113.4686	1079.9313 (95)
Ext temp.	5.0000	5.6000	7.3000	9.7000	12.7000	15.5000	17.5000	17.3000	14.9000	11.5000	8.0000	5.0000 (96)
Heat loss rate W	3385.2903	3260.4308	2925.7110	2423.7664	1761.7776	1102.3202	609.3491	657.8779	1229.9411	1972.8054	2702.8669	3351.9193 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	1661.8660	1336.9196	1126.7426	653.6978	277.7362	0.0000	0.0000	0.0000	0.0000	606.0434	1144.3668	1690.3590 (98)
Space heating												8497.7314 (98)
RHI space heating demand												8498 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	112.2300 (1b)	2.5300 (2b)	283.9419 (1b) - (3b)
First floor	98.4500 (1c)	2.7300 (2c)	268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.0905 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3405 (18)
Number of sides sheltered				0	0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3405 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4341	0.4256	0.4171	0.3745	0.3660	0.3234	0.3234	0.3149	0.3405	0.3660	0.3830	0.4000 (22b)
	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5800 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			25.6300	1.3258	33.9792		(27)
Bifold Door (Uw = 1.40)			8.0500	1.3258	10.6723		(27)
Side Door			2.3800	1.4000	3.3320		(26a)
Heat Loss Floor			112.2300	0.1200	13.4676	75.0000	8417.2500 (28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238	60.0000	12174.6000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.4900		11.4900	0.1400	1.6086	9.0000	103.4100 (30)
Pitched Cold Roof	98.4500		98.4500	0.1000	9.8450	9.0000	886.0500 (30)
Total net area of external elements Aum(A, m2)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.0370		(33)
Internal Wall Masonry			112.9500			75.0000	8471.2500 (32c)
Internal Wall Timber			184.2800			9.0000	1658.5200 (32c)
Internal Floor			98.4500			18.0000	1772.1000 (32d)
Internal Ceiling			98.4500			18.0000	1772.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	35276.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							167.4391 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.8357 (36)
Total fabric heat loss						(33) + (36) =	153.8727 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.3819	107.7146	107.0605	103.9883	103.4135	100.7377	100.7377	100.2422	101.7684	103.4135	104.5763	105.7920 (38)
Heat transfer coeff	262.2547	261.5874	260.9333	257.8610	257.2862	254.6104	254.6104	254.1149	255.6411	257.2862	258.4490	259.6647 (39)
Average = Sum(39)m / 12 =												257.8583 (39)
HLP	1.2448	1.2416	1.2385	1.2239	1.2212	1.2085	1.2085	1.2062	1.2134	1.2212	1.2267	1.2325 (40)
HLP (average)												1.2239 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0158 (42)
Average daily hot water use (litres/day)												105.8255 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1665.0476 (45)
Water storage loss:	25.8945	22.6475	23.3702	20.3747	19.5500	16.8701	15.6327	17.9387	18.1530	21.1555	23.0929	25.0774 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (64)
Total per year (kWh/year) = Sum(64)m =												2382.4186 (64)
Heat gains from water heating, kWh/month												
	106.1413	94.2269	100.5458	92.3335	92.0777	84.5651	83.3943	88.5061	87.4087	95.6367	98.3589	104.3302 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6261	78.7169	64.0169	48.4649	36.2281	30.5853	33.0485	42.9577	57.6577	73.2097	85.4465	91.0893 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	568.7846	574.6868	559.8135	528.1498	488.1802	450.6143	425.5181	419.6158	434.4892	466.1528	506.1225	543.6883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)	142.6631	140.2185	135.1422	128.2409	123.7604	117.4515	112.0892	118.9598	121.4009	128.5439	136.6096	140.2287 (72)
Total internal gains	919.5007	913.0492	878.3994	824.2826	767.5955	718.0781	690.0826	700.9602	732.9747	787.3334	847.6055	894.4333 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.0300	11.2829	0.6300	0.7000	0.7700	10.4481 (75)						
Southeast	5.8300	36.7938	0.6300	0.7000	0.7700	65.5564 (77)						
Southwest	5.0600	36.7938	0.6300	0.7000	0.7700	56.8980 (79)						
Northwest	11.7100	11.2829	0.6300	0.7000	0.7700	40.3786 (81)						
North	8.0500	10.6334	0.6300	0.7000	0.7700	26.1601 (74)						
Solar gains	199.4413	362.0378	556.7468	796.1949	991.3867	1028.6886	973.2095	820.3467	638.2933	416.4770	242.8972	168.1115 (83)
Total gains	1118.9420	1275.0870	1435.1463	1620.4774	1758.9822	1746.7667	1663.2921	1521.3069	1371.2681	1203.8103	1090.5027	1062.5448 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.3641	37.4594	37.5533	38.0007	38.0856	38.4859	38.4859	38.5609	38.3307	38.0856	37.9143	37.7368
alpha	3.4909	3.4973	3.5036	3.5334	3.5390	3.5657	3.5657	3.5707	3.5554	3.5390	3.5276	3.5158
util living area	0.9936	0.9893	0.9789	0.9500	0.8816	0.7531	0.6092	0.6691	0.8668	0.9665	0.9896	0.9947 (86)
MIT	19.4779	19.6175	19.8697	20.2212	20.5493	20.7842	20.8766	20.8570	20.6678	20.2513	19.8074	19.4575 (87)
Th 2	19.8843	19.8868	19.8893	19.9009	19.9031	19.9132	19.9132	19.9151	19.9093	19.9031	19.8987	19.8941 (88)
util rest of house	0.9921	0.9866	0.9734	0.9356	0.8447	0.6725	0.4839	0.5475	0.8105	0.9543	0.9865	0.9934 (89)
MIT 2	17.8434	18.0485	18.4167	18.9296	19.3845	19.6860	19.7770	19.7649	19.5543	18.9807	18.3350	17.8205 (90)
Living area fraction									fLA = Living area / (4) =			0.0993 (91)
MIT	18.0057	18.2044	18.5611	19.0579	19.5002	19.7951	19.8863	19.8734	19.6649	19.1070	18.4812	17.9831 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0057	18.2044	18.5611	19.0579	19.5002	19.7951	19.8863	19.8734	19.6649	19.1070	18.4812	17.9831 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1105.7634	1250.7046	1383.7964	1492.7314	1456.4101	1157.0445	799.2049	824.7933	1089.6007	1133.8733	1069.5537	1052.0515 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	3594.3955	3480.2584	3147.1296	2619.3232	2006.8764	1322.7202	836.7191	882.6359	1422.6100	2188.7220	2941.4726	3578.9851 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	1851.5423	1498.2601	1311.9198	811.1461	409.5469	0.0000	0.0000	0.0000	0.0000	784.8074	1347.7816	1880.0386 (98)
Space heating												9895.0429 (98)
Space heating per m2												(98) / (4) = 46.9672 (99)

 8c. Space cooling requirement

 Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												9818.6754 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1851.5423	1498.2601	1311.9198	811.1461	409.5469	0.0000	0.0000	0.0000	0.0000	784.8074	1347.7816	1880.0386	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1837.2526	1486.6969	1301.7948	804.8859	406.3861	0.0000	0.0000	0.0000	0.0000	778.7505	1337.3798	1865.5289	(211)
Water heating requirement	284.8527	230.5016	201.8338	124.7917	63.0072	0.0000	0.0000	0.0000	0.0000	120.7396	207.3510	289.2367	(215)
Water heating requirement	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102	(64)
Efficiency of water heater (217)m	89.2329	89.1202	88.8568	88.2149	86.7368	80.0000	80.0000	80.0000	80.0000	88.0805	88.9241	89.2814	(217)
Fuel for water heating, kWh/month	261.7390	231.1645	243.9075	220.8167	220.5070	214.2871	206.4315	225.6486	224.9772	229.2952	239.4344	255.4958	(219)
Water heating fuel used												2773.7044	(219)
Annual totals kWh/year													
Space heating fuel - main system													9818.6754 (211)
Space heating fuel - secondary													1522.3143 (215)

Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													626.0659 (232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 3.20 * 1029 * 1.00) =										-2634.7180			-2634.7180 (233)
Total delivered energy for all uses													12181.0420 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9818.6754	3.4800	341.6899	(240)
Space heating - secondary	1522.3143	4.2300	64.3939	(242)
Water heating (other fuel)	2773.7044	3.4800	96.5249	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	626.0659	13.1900	82.5781	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-2634.7180	13.1900	-347.5193	(252)
Total energy cost			367.5600	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.6038 (257)
SAP value			91.5772
SAP rating (Section 12)			92 (258)
SAP band			A

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9818.6754	0.2160	2120.8339	(261)
Space heating - secondary	1522.3143	0.0190	28.9240	(263)
Water heating (other fuel)	2773.7044	0.2160	599.1201	(264)
Space and water heating			2748.8780	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	626.0659	0.5190	324.9282	(268)
Energy saving/generation technologies				
PV Unit	-2634.7180	0.5190	-1367.4186	(269)
Total kg/year			1745.3126	(272)
CO2 emissions per m2			8.2800	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI value 90.8529
EI rating 91 (274)
EI band B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9070 = 4.115$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9070 = 0.2554$, stars = 4
Water heating energy efficiency	$3.48 / 0.8570 = 4.060$, stars = 4
Water heating environmental impact	$0.216 / 0.8570 = 0.2520$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	112.2300 (1b)	x 2.5300 (2b)	= 283.9419 (1b) - (3b)
First floor	98.4500 (1c)	x 2.7300 (2c)	= 268.7685 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	210.6800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 552.7104 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				5 * 10 =	50.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				50.0000 / (5) =	0.0905 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3405 (18)	
Number of sides sheltered				0 (19)	
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3405 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.9000	3.7000	3.6000	3.3000	3.3000	3.2000	3.2000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.9250	0.9000	0.8250	0.8250	0.8000	0.8000	0.8500	0.8250	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3490	0.3234	0.3320	0.3149	0.3064	0.2809	0.2809	0.2724	0.2724	0.2894	0.2809	0.3149 (22b)
	0.5609	0.5523	0.5551	0.5496	0.5469	0.5394	0.5394	0.5371	0.5371	0.5419	0.5394	0.5496 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			25.6300	1.3258	33.9792		(27)
Bifold Door (Uw = 1.40)			8.0500	1.3258	10.6723		(27)
Side Door			2.3800	1.4000	3.3320		(26a)
Heat Loss Floor			112.2300	0.1200	13.4676	75.0000	8417.2500 (28a)
External Walls	241.3000	38.3900	202.9100	0.1800	36.5238	60.0000	12174.6000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.4900		11.4900	0.1400	1.6086	9.0000	103.4100 (30)
Pitched Cold Roof	98.4500		98.4500	0.1000	9.8450	9.0000	886.0500 (30)
Total net area of external elements Aum(A, m ²)			465.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.0370		(33)
Internal Wall Masonry			112.9500			75.0000	8471.2500 (32c)
Internal Wall Timber			184.2800			9.0000	1658.5200 (32c)
Internal Floor			98.4500			18.0000	1772.1000 (32d)
Internal Ceiling			98.4500			18.0000	1772.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	35276.0700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.4391 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							40.8357 (36)
Total fabric heat loss						(33) + (36) =	153.8727 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	102.3035	100.7377	101.2464	100.2422	99.7598	98.3922	98.3922	97.9628	97.9628	98.8349	98.3922	100.2422 (38)
Heat transfer coeff	256.1762	254.6104	255.1191	254.1149	253.6326	252.2649	252.2649	251.8355	251.8355	252.7076	252.2649	254.1149 (39)
Average = Sum(39)m / 12 =												253.4118 (39)
HLP	1.2159	1.2085	1.2109	1.2062	1.2039	1.1974	1.1974	1.1953	1.1953	1.1995	1.1974	1.2062 (40)
HLP (average)												1.2028 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0158 (42)
Average daily hot water use (litres/day)												105.8255 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy conte	116.4081	112.1751	107.9420	103.7090	99.4760	95.2430	95.2430	99.4760	103.7090	107.9420	112.1751	116.4081 (44)
Energy content (annual)	172.6298	150.9831	155.8011	135.8312	130.3332	112.4677	104.2178	119.5915	121.0198	141.0369	153.9528	167.1828 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1665.0476 (45)
Water storage loss:	25.8945	22.6475	23.3702	20.3747	19.5500	16.8701	15.6327	17.9387	18.1530	21.1555	23.0929	25.0774 (46)
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (64)
Heat gains from water heating, kWh/month	106.1413	94.2269	100.5458	92.3335	92.0777	84.5651	83.3943	88.5061	87.4087	95.6367	98.3589	104.3302 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487	180.9487 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.6261	78.7169	64.0169	48.4649	36.2281	30.5853	33.0485	42.9577	57.6577	73.2097	85.4465	91.0893 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	568.7846	574.6868	559.8135	528.1498	488.1802	450.6143	425.5181	419.6158	434.4892	466.1528	506.1225	543.6883 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107	56.1107 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325	-120.6325 (71)
Water heating gains (Table 5)	142.6631	140.2185	135.1422	128.2409	123.7604	117.4515	112.0892	118.9598	121.4009	128.5439	136.6096	140.2287 (72)
Total internal gains	919.5007	913.0492	878.3994	824.2826	767.5955	718.0781	690.0826	700.9602	732.9747	787.3334	847.6055	894.4333 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.0300	14.6223	0.6300	0.7000	0.7700	13.5404 (75)						
Southeast	5.8300	45.2918	0.6300	0.7000	0.7700	80.6974 (77)						
Southwest	5.0600	45.2918	0.6300	0.7000	0.7700	70.0393 (79)						
Northwest	11.7100	14.6223	0.6300	0.7000	0.7700	52.3293 (81)						
North	8.0500	13.4995	0.6300	0.7000	0.7700	33.2112 (74)						
Solar gains	249.8176	387.9065	600.2748	866.7334	1024.7021	1156.9184	1074.8074	929.0514	724.9366	476.7110	296.6151	199.0775 (83)
Total gains	1169.3183	1300.9556	1478.6743	1691.0160	1792.2976	1874.9964	1764.8900	1630.0116	1457.9113	1264.0443	1144.2206	1093.5107 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.2507	38.4859	38.4091	38.5609	38.6343	38.8437	38.8437	38.9100	38.9100	38.7757	38.8437	38.5609
alpha	3.5500	3.5657	3.5606	3.5707	3.5756	3.5896	3.5896	3.5940	3.5940	3.5850	3.5896	3.5707
util living area	0.9916	0.9868	0.9725	0.9319	0.8396	0.6528	0.4786	0.5361	0.8023	0.9499	0.9850	0.9933 (86)
MIT	19.6154	19.7481	20.0072	20.3462	20.6564	20.8517	20.9076	20.8990	20.7609	20.3883	19.9622	19.5946 (87)
Th 2	19.9073	19.9132	19.9113	19.9151	19.9169	19.9221	19.9221	19.9237	19.9237	19.9204	19.9221	19.9151 (88)
util rest of house	0.9896	0.9835	0.9651	0.9122	0.7896	0.5538	0.3411	0.3958	0.7238	0.9309	0.9805	0.9916 (89)
MIT 2	18.0602	18.2575	18.6313	19.1158	19.5348	19.7614	19.8061	19.8035	19.6761	19.1874	18.5768	18.0357 (90)
Living area fraction	18.2147	18.4056	18.7680	19.2381	19.6462	19.8697	19.9155	19.9123	19.7839	19.3067	18.7144	18.1906 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2147	18.4056	18.7680	19.2381	19.6462	19.8697	19.9155	19.9123	19.7839	19.3067	18.7144	18.1906 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1151.5995	1270.9672	1411.2720	1515.8528	1388.4762	1028.3757	600.5104	642.5932	1037.3982	1158.2309	1113.4686	1079.9313 (95)
Ext temp.	5.0000	5.6000	7.3000	9.7000	12.7000	15.5000	17.5000	17.3000	14.9000	11.5000	8.0000	5.0000 (96)
Heat loss rate W	3385.2903	3260.4308	2925.7110	2423.7664	1761.7776	1102.3202	609.3491	657.8779	1229.9411	1972.8054	2702.8669	3351.9193 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

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Space heating kWh	1661.8660	1336.9196	1126.7426	653.6978	277.7362	0.0000	0.0000	0.0000	0.0000	606.0434	1144.3668	1690.3590 (98)
Space heating												8497.7314 (98)
Space heating per m2												(98) / (4) = 40.3348 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)
Efficiency of main space heating system 1 (in %)	90.7000 (206)
Efficiency of secondary/supplementary heating system, %	65.0000 (208)
Space heating requirement	8432.1480 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1661.8660	1336.9196	1126.7426	653.6978	277.7362	0.0000	0.0000	0.0000	0.0000	606.0434	1144.3668	1690.3590 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	1649.0401	1326.6016	1118.0467	648.6527	275.5927	0.0000	0.0000	0.0000	0.0000	601.3661	1135.5348	1677.3132 (211)
Water heating requirement	255.6717	205.6799	173.3450	100.5689	42.7287	0.0000	0.0000	0.0000	0.0000	93.2375	176.0564	260.0552 (215)
Water heating requirement	233.5572	206.0143	216.7285	194.7932	191.2606	171.4297	165.1452	180.5189	179.9818	201.9643	212.9148	228.1102 (64)
Efficiency of water heater (217)m	89.0906	88.9606	88.6130	87.7797	85.7296	80.0000	80.0000	80.0000	80.0000	87.5363	88.6683	89.1453 (217)
Fuel for water heating, kWh/month	262.1570	231.5793	244.5786	221.9115	223.0976	214.2871	206.4315	225.6486	224.9772	230.7207	240.1249	255.8857 (219)
Water heating fuel used												2781.3998 (219)
Annual totals kWh/year												8432.1480 (211)
Space heating fuel - main system												1307.3433 (215)
Space heating fuel - secondary												

Electricity for pumps and fans:

central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	75.0000 (231)
Electricity for lighting (calculated in Appendix L)	626.0659 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 3.20 * 1139 * 1.00) =	-2916.0666	-2916.0666 (233)
Total delivered energy for all uses		10305.8904 (238)

10a. Fuel costs - using BEDF prices (512)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8432.1480	9.7400	821.2912 (240)
Space heating - secondary	1307.3433	10.2500	134.0027 (242)
Water heating (other fuel)	2781.3998	9.7400	270.9083 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	626.0659	36.8500	230.7053 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-2916.0666	36.8500	-1074.5705 (252)
Total energy cost			513.9745 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	8432.1480	0.2160	1821.3440 (261)
Space heating - secondary	1307.3433	0.0190	24.8395 (263)
Water heating (other fuel)	2781.3998	0.2160	600.7824 (264)
Space and water heating			2446.9658 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	626.0659	0.5190	324.9282 (268)
Energy saving/generation technologies			
PV Unit	-2916.0666	0.5190	-1513.4386 (269)
Total kg/year			1297.3805 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	8432.1480	1.2200	10287.2206 (261)
Space heating - secondary	1307.3433	1.0400	1359.6370 (263)
Water heating (other fuel)	2781.3998	1.2200	3393.3077 (264)
Space and water heating			15040.1653 (265)

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Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	626.0659	3.0700	1922.0222 (268)
Energy saving/generation technologies			
PV Unit	-2916.0666	3.0700	-8952.3244 (269)
Primary energy kWh/year			8240.1132 (272)
Primary energy kWh/m ² /year			39.1120 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
 Current environmental impact rating: B 91

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
 (none)

Measures omitted - SAP change or cost saving too small:
 N Solar water heating + 0.9 -£ 115 -271 kg (20.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)	Total Savings £0		0.00 kg/m ²

Potential energy efficiency rating: A 92
 Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 512 TEST (15 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£258	£258	£0
Mains gas	£1196	£1196	£0
Wood	£134	£134	£0
Space heating	£1087	£1087	£0
Water heating	£271	£271	£0
Lighting	£231	£231	£0
Generated (PV)	-£1075	-£1075	£0
Total cost of fuels	£513	£513	£0
Total cost of uses	£514	£514	£0
Delivered energy	49 kWh/m ²	49 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m ²	6 kg/m ²	6 kg/m ²	0 kg/m ²
Primary energy	39 kWh/m ²	39 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	167.4 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1459.16 (P1)
Transmission heat loss coefficient	153.87 (37)
Summer heat loss coefficient	1613.03 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
North East	0.000	1.000	None
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	3.0300	106.0502	0.6300	0.7000	0.9000	114.7831
South East	5.8300	127.3119	0.6300	0.7000	0.9000	265.1313
South West	5.0600	127.3119	0.6300	0.7000	0.9000	230.1140
North West	11.7100	106.0502	0.6300	0.7000	0.9000	443.6005
North	8.0500	87.1704	0.6300	0.7000	0.9000	250.6621

total: 1304.2910

	Jun	Jul	Aug	
Solar gains	1412	1304	1122	(P3)
Internal gains	715	687	698	
Total summer gains	2127	1991	1820	(P5)

	1.32	1.23	1.13	(P6)
Summer gain/loss ratio	1.32	1.23	1.13	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 167.4)	0.83	0.83	0.83	
Threshold temperature	17.55	19.36	19.26	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

PREDICTED ENERGY ASSESSMENT

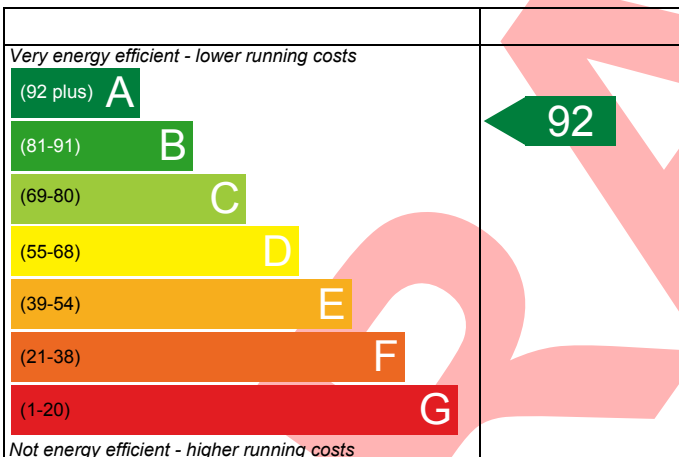
Tree House, Larg Drive,
Winchester,
Hampshire,
SO22 6NU

Dwelling type: House, Detached
Date of assessment: 01/03/2023
Produced by: Scott Spearing
Total floor area: 210.68 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

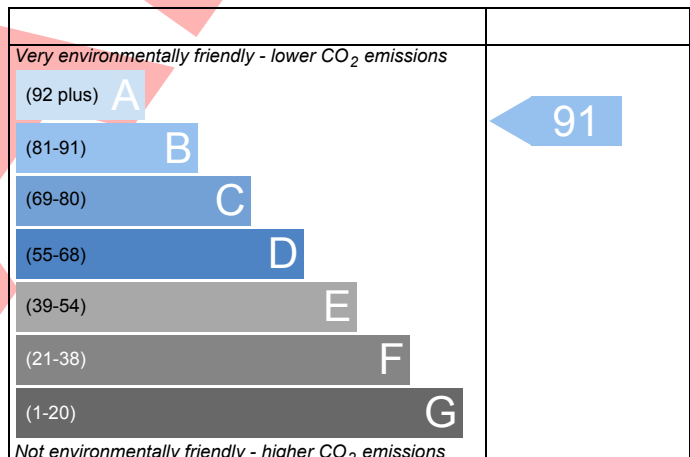
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.